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ECONOMY OF THE FARMER

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The depression is felt everywhere. The average farmer generally falls an easy victim to it because he is improvident, ignorant, conservative and uneconomical in his dealings. He is unable to say what his cost of producing 1000 lbs. of paddy is. Without exactly knowing what it is, he is selling the produce to the highest bidder who offers a price per cartload, say, 1000 lbs. The purchaser fully realises the fact that his prices are always lower than the ordinary wholesale market rates and he is sure of a margin of profit in his business. On account of the quick and easy transport facilities, the Indian producer who is following the time-honoured crude and apparently cheap but on the whole costly ways of farming, has to compete with the up-to-date civilised farmer of the West who adopts the latest labour-saving appliances in his production with due regard to economy. The civilised farmer always stops producing any commodity when he finds that the trade is not prepared to pay him at least his cost price. The Indian farmer not knowing what his cost price is and following his time-honoured ways and pinning his faith to the same old crops, does not know whether he actually loses or gets a profit when he sells his produce at a given rate per unit.

The land-owner and producer in South India are always finding fault with the high transport charges by rail etc., while none of them considers seriously as to how far, one can improve the methods so as to reduce one's cost of production.

As regards paddy cultivation, ploughing charges are saved by at least 20% by the use of improved implements which are more efficient. Cost of seed is reduced by 25% as the reduction of the quantity is found possible when improved strains of paddy are grown. No outside manure need be purchased and the manuring charges can be maintained where it was or reduced to almost nothing, if the ryot improves his ways of collecting and conserving cattle manure. This will enable him to improve the quality and increase the quantity of manure. The increase in manure supply can be about 50% and it will easily outgrow the effect of any other improvement adopted by the farmer. Taking the more prominent items alone into consideration, the position is as below:—

The increase for the improved seed alone is 10% of the yield.

The increase of yield for the better manuring is not less than 50%.

It may be manuring over a larger area or more manure in the same area when the manuring is poor. Thus easily a careful ryot can increase his income by about 60% as shown above and reduce the expenditure by 10%.

The account will be roughly as below for a Tanjore ryot:—

	Present cost.	Reduced cost.
Cost of ploughing	5—0—0	4—0—0
Cost of manure	8—0—0	8—0—0
Cost of seed	2—0—0	1—8—0
Cost of planting and thinning	2—8—0	2—8—0
Cost of weeding	2—0—0	2—0—0
Total	20—0—0	18—0—0

Harvest is paid for in kind and hence not taken into account. Value of straw has been put as a set off against the assessment. The capital invested in the price of land is left out of consideration since the profits are due to it.

To calculate cost per unit of produce, cost of production may now be put down as Rs. 20 per acre for 1700 lbs. in Tanjore. That is equivalent to Rs. 11—12—3 for 1000 lbs. Cost of production as per improved methods is Rs. 18 per acre for 2720 lbs. yield per acre; it means Rs. 6—10—0 per 1000 lbs. Reducing it per *kalam* of 64 lbs. the cost of production comes Rs. 0—12—9 per *kalam* in the old way and Rs. 0—6—9 per *kalam* under the improved system.

Calculating the cost of production per unit must be the ordinary way that a ryot should adopt. The idea of calculating cost of cultivation per acre and yield in lbs. will give him no easy solution of the

problem as to whether he is a loser if he sells his produce in a particular market at a particular rate per unit.

By increasing the dose of manure or other treatments given at a heavy cost one ryot is able to increase his acre yield very considerably. Whether it is economical to do so is a question yet remaining unsolved. Calculating the cost of production per unit of the produce as above, will immediately warn the producer to remain within economic limits.

Therefore I suggest that calculations of the cost of production must not end with cost of production and yield per acre, but must proceed further and should be resolved into the cost of production per trade unit of any produce if the producer must know his own economic position at any stage. It is, I believe, the want of such a clear idea of the economic position that does not induce the average wet land farmer to go in for any crop other than paddy and adopt other improvements suggested by the Agricultural Department as rapidly as he should.

AGRICULTURAL METEOROLOGICAL PROBLEMS.

BY S. AUDINARAYANAN, M. A.

Agricultural meteorology deals with the influences of weather on vegetation, particularly on animal life, vegetable food and textile supplies of the nations of the world. That agriculture depends both on the climate and the periodical variations of weather is a well known fact. But the relations are very complicated and there is difficulty in separating the effects of the several factors. So much so, the progress made in applying the data in meteorology to the purposes of agriculture is not as much as might have been expected. The greatest obstacle to the progress is the great inaccuracy in the data expressing acreage and yield. The meteorologist engaged in the study of weather and crop relations is constantly confronted with the internal evidence of gross inaccuracies and lack of homogenity in acreage and yield values.

A definite advance seems to have been made by the establishment of the Agricultural Meteorological Section under the Indian Meteorological Department. Their programme of work on the Research side includes the investigation of best methods and standardisation of those methods for the measurements of radiation, evaporation, soil temperature, and soil humidity so that these data may ultimately be systematically maintained in addition to those of air temperature, air humidity, rainfall, wind, sunshine etc. The Statistical Officer under the Imperial Council of Agricultural Research is travelling from province to province and is taking every effort to improve the defects in the collection of acreage and yield statistics. But the records at the several Agricultural Farms should be very accurate to be capable of yielding very good results.

At Lyallpur the cotton crop is being subjected to systematic experimentation and results of a far-reaching nature are anticipated. There the results of early and late waterings are being investigated. Also work is being carried out on the causes of the partial failures of the Punjab-American cottons. A very detailed study of the reactions of the plant to various environmental factors is being made which includes an examination of the moisture content of the soil correlated with the speed with which water passes up the stem of the plant, age of the leaves on different portions of the plant relative to their size, the carbohydrates in the various tissues of the plant body and the size and weight of bolls as affected by condition of growth. Such investigations must be started at the several Agricultural Farms and the Agricultural Department must make themselves, responsible for meteorological studies relating to the influence of weather conditions on the growing crop.

Temperature. rainfall and sunshine are some of the very important factors that control climate. A broad climatic belt gives the nature of plants growing and there is also a narrow belt in which certain plants will grow. There is what is called optimum combinations of temperature, moisture and sunshine in which plants make their best growth and under which largest of yields will be obtained. Food is available to the roots of the plants only in a soluble form and it is carried up the plant and converted into vegetable tissue under the influence of solar energy which is expressed in heat units or calories. Different plants require unlike proportions of moisture, heat and sunshine. Many plants have a certain period during growth when there must be a well-defined combination of certain weather factors to produce large crop-yields. To determine these critical periods laboratory experiments must be performed side by side with field observations and the several factors must be correlated mathematically from past records. Anticipation of a type of weather known to be injurious or beneficial is of paramount advantage. This line of research requires attention.

High and low temperatures affect crops in various ways. But the principal ones are prevention of germination, checking of growth, killing all or part of the vegetative parts, injuring the blossoms or damaging the maturing parts. Also there are certain definite temperatures below which a plant will make no growth. This zero of vital temperature point is 43°F or 6°C. Kincer in U.S A. has suggested that the zero of the spring-seeded crops should be the mean daily temperature about the average date of the beginning of planting. Such temperatures have been determined for the following cases.

Spring Wheat	37° to 40°.
Oats	43°.
Potatoes	45°.
Corn	55°.
Cotton	60° to 62°.

Rainfall. The problem of dealing with the entire range of rainfall from the lowest to the highest limit between which any cultivation of crop is carried on, is not a very difficult one. Though emperical grouping of factors will solve the problem, yet more advanced mathematical methods could be used for calculating and fitting regression curves which is expected to be of wider applicability and more fertile of results.

Soil. Physical circumstances and properties of the soil are of much importance to agriculture. Schubler has tried to find the effect of the colour of the soil on the absorption of radiated heat and the influence of moisture in the soil. A wet soil takes a longer time to warm or cool than a dry one. In permeable soils, rain carries down with it the temperature of the air and the surface layers. The relative importance of the temperature of the air and the soil upon plant growth presents difficulties. The power of the soil to retain water is important in its effect on the temperature of the soil and supply of water to the plant. Necessity of water increases with the nature of the sub-soil, the closeness of the stand of plants, size of leaves, dryness of air, velocity of wind and temperature.

Complete hydrodynamic solution of the movement of sub-soil water has not so far been obtained, but on the assumption that the velocity is proportional to the first differential of the relative saturation of the sub-soil and that the ratio of the surface of all particles per unit volume to the saturation quantity of moisture is constant, an integrable equation results for a linear change of particle surface with depth.

Sunshine. No plant life is perfected and reaches its maturity except through the influence of short wave solar energy. Dark rays of heat can replace sunlight in the growth of vegetation but sunlight can partially replace heat. Sunlight-hour-degree is the measure and is the product of the mean daily heat required to grow and mature and the possible number of hours of sunshine from planting to harvesting.

An enquiry into the relationship between meteorology and a crop or crops in any given district only shows what variations of weather are most desirable in that locality. For, in England the correlation between winter rainfall and subsequent spring crops was found by Hooker to be negative, whereas S. M. Jacob found the same correlation for the Punjab as positive. These opposite conclusions do not prove that correlation is useless but that care is necessary in scrutinising the results. It can rarely establish the standard that the crop really prefers.

The results obtained by Jacob, Wallen and others are a sufficient warrant that the method of correlation is an exceedingly powerful

weapon in the hands of a crop fore-caster. It is abundantly clear that the weather plays a part invisible to the eye in the internal structure of the plant that can be measured by such statistics. These numerical records must be worked up and the results taken into serious consideration and used in conjunction with the facts such as are learned by actual observation in the fields, for fore-telling the future harvest. Far more investigation is yet required into the behaviour of different crops under different conditions of weather Though the problems are well defined yet the progress recorded has been singularly small.

In India, there is a vast store-house of valuable statistics awaiting expert knowledge and intelligent shifting. The method of correlation is by no means the only way of attack but its vitality is shown by the remarkable series of co-efficients obtained by Hooker in 1922. J. W. Smith has found the weather index of factors injurious to plant growth and finds a correlation between that index and the yield. R. A. Fisher has another method but has put his finger in a weak spot in the method of correlation. As you correlate yield with finer and finer time intervals of rainfall, the co-efficient tends to zero. Applications of statistical methods has been well recognised and what is to be considered is how far the Indian Statistics are going to throw light on the connection of weather conditions and yield.

The main sources of yield data in India are (1) the record of crop experiments by the Government revenue staff during settlement operations and routine of district administrations which gives only a discontinuous series which would not repay closer examination. (2) the record of failed crops noted by village revenue agency which if cautiously handled would give some useful result. (3) agricultural department experimental station records which are the most reliable. and lastly, and (4) the season reports of the Directors of Agriculture.

Jacob is of opinion that though fairly favourable as the conditions in India are for the study agricultural meteorology, yet for the solutions of the problems of agronomic meteorology-which concerns with the direct effect of rainfall, temperature, sunshine and winds in inducing the cultivator to bring varying amounts of unirrigated lands under the plough or of restricting or increasing the use of artificial sources of irrigation—the data provided in North India are unsurpassed in the whole world for the space and time they cover, their accuracy and continuity. The statistician who does not become the slave either of his satistical material or of his mathematical methods can obtain a clue to the variations of crop areas with variations of climate and weather. Though not well served in the side of yield statistics he will have an opportunity of helping to solve some of the world problems of agricultural meteorology.

The several methods of agricultural meteorological research are (1) Laboratory studies with plants, animals under completely

controlled conditions, of the effect of different kinds of temperature, humidity, light etc. in conjunction with different soils and different kinds of nutrition. (2) Pot culture studies in which factors other than the weather are controlled and statistical methods are used to ascertain, the effect of the different weather factors. (3) Field studies in which measurements of crop growth and yield and of the intensity of attack of diseases and pests on the one hand and meteorological factors on the other are carried out side by side. Analogous studies on animals are carried out by observations of the healthy fecundity etc. of herds and flocks in conjunction with meteorological records, and (4) Statistical studies in which records of crop yields and weather over a long series of year are correlated.

Insect pests and plant diseases. Value of forecasts of seasonal appearance of insect pests and plant diseases and their mass outbreaks, and research on the relation between meteorological factors and insect activities and plant diseases, are problems that have immediate bearing on the subject.

Investigations should be carried out on the following lines. (1) Application of climograph method to studies in distribution, seasonal cycle of development and periodic fluctuation in the number of insects. (2) Effect of atmospheric motion on the distribution of insects. (3) The insect fauna of upper atmosphere (4) Influence of the colouration of insects on their thermal economy. (5) Effects of atmospheric pressure on insect activities and development. (6) Part played by light in the development of insects. (7) Determination of the distribution of the fungus spores by the winds in close co-operation with the metorologist, by the plant pathologist, and (8) Relation of weather to healthy crop growth and yield.

For each important crop plant, during the whole period of its growth and maturation, the following meteorological data should be recorded. (1) Air temperature (*a*) above the crop, (*b*) at the level of the top of the crop, (*c*) at midcrop height, (*d*) at the base, (*e*) in the soil, recorded every two or three hours or by a continuous recorder. (2) Moisture content of the land (*a*) at base near the crop, (*b*) under the crop, the usual precipitation records measured twice daily and nightly. (3) Relative humidity of the air (*a*) above the crop, (*b*) at the level of the top of the crop, (*c*) at each quarter of its height, (*d*) at the base. (4) Cloud records and sunlight intensity. (5) Relative penetration of precipitation into a crop at each degree of density and the length of time moisture remains on the foliage. (6) The relative amounts of dew deposited on crops of different heights for each stage of temperature, moisture and humidity as well as of crop density. (7) Relative penetration of wind of varying degrees of force into the crop and its relation to crop humidity, temperature and spore dispersal. (8) The humidity and temperature of the higher air strata.

and (9) More information about air currents and spore dispersal. The methods of collection of these data should be left to the meteorologist himself. The analysis of these data is a problem involving deep analytical and higher mathematical treatment.

UTILISATION OF DAIRY WASTES.*

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The subject of this paper relates to the utilisation of the waste products of the dairy and is based mainly on certain experiments conducted in 1918 with the object of investigating the possibility of manufacturing locally, food and other products which could replace similar products which used to be then and still to a large extent are imported from outside, but which war conditions had rendered very difficult to obtain.

When milk coming into the dairy could be all disposed of as milk there will be of course no waste, but where the demand for fresh milk is limited and production is considerably in excess of such demand the milk will have to be converted into cream or butter or cheese and these processes would always leave a certain amount of waste in the form of skim milk or whey. If, however, by some means these waste products could be converted into something of marketable value not only such waste could be prevented but the mother industry could be made more profitable.

Skim milk contains about 3% of the protein, casein, held in colloidal suspension. The latter is easily separated by precipitation with acids. On a large scale the separation is best effected by the addition of sulphuric acid. In the experiments referred to above, the precipitation was effected by mixing one and a half parts by volume of strong sulphuric acid with seven parts of water and adding the mixture to 1,000 parts of milk. The precipitated casein was washed, pressed to free it of superfluous water and dried in a draught oven at a moderate temperature and finally powdered as fine as possible.

A purer product can be obtained by dissolving the moist casein in the least possible quantity of ammonia and reprecipitating with acid. This process is repeated three or four times. The curd is washed several times with alcohol, extracted with ether in a soxhlet apparatus and finally dried.

Casein has been found to lend itself to an enormous number of uses in industry. The uses to which it is put is increasing year by year. There are probably very few industries in which casein does

* Paper contributed towards a symposium on 'Utilisation of Wastes' and read at a Combined Conference of the Association of Economic Biologists, Coimbatore, The Indian Chemical Society and the Society of Biochemists, Bangalore.

not or cannot advantageously get employed. Thus it is used in the manufacture of distempers, cardboard, paper glazing, leather dressing, soap manufacture, cotton sizing and water-proofing, calico printing, boot polishes, water proof cements, invalid foods, and imitations of bones, ivory, tortoise shell etc.

Casein Paints and distempers. Casein prepared in the manner above described is soluble in solutions of the hydroxides of the alkali and alkaline earthy metals and in many cases of their salts as well, although the quantity of each required for complete solution is different in each case. Thus of sodium hydroxide 1¾%, sodium carbonate 2¾%, sodium bicarbonate 3½%, sodium tungstate 12½% of the casein are required for complete solution. Solutions of borax and ordinary soap also dissolve casein.

Casein similarly dissolves in lime water although to a less extent, but the casein-lime compound thus formed has the property of absorbing carbon dioxide from the air and forming an insoluble compound. It is this property of casein which lends itself to the preparation of casein paints and distempers. These consist of mixtures of casein and slaked lime along with suitable pigments. On the addition of water the casein and lime combine to form a sticky soluble product holding the pigment in suspension. When applied to any suitable surface—wall, timber, or iron, the casein-lime compound in the prepared distemper absorbs carbon di-oxide from the air forming an insoluble durable coating which does not wash or rub off.

The proportions of the various ingredients forming the mixture is important. Too little lime would tend to make the product insoluble and too much would induce the paint to come off in flakes. Similarly too little paint would make the coating brittle and liable to flake off while if too much, the paint will rub off and not stand washing. Further, not all pigments could be used in the mixture, but only those which are not affected by lime. It is, however, possible to select suitable pigments to cover a full range of colours.

White paint may be made up of 100 parts each of casein and lime, levigated chalk 800, borax 1, and ultra-marine 2 to 3 parts by weight. while coloured paints may consist of similar proportions of casein and lime 400 each of levigated chalk and pigment, and borax one part. The ingredients should be all finely powdered and thoroughly dry. The mixture when stored in air-tight boxes will keep indefinitely.

For use, 50—60 parts of water are added to 100 parts of the powder and stirred until the mass is homogenous and free from lumps. This is then covered with a thin layer of water and set aside for the space of about one hour, after which the mass is stirred with more water to the consistency of oil paint. The paint thus prepared should be used without delay as it is liable to set hard in a comparatively short time, becoming unfit for use in twelve hours. The paint which

can be applied to any clean surface such as lime, plaster of paris, cement, brick, timber, stone, metal or canvas dries quickly with a mat surface and after 36—48 hours can be washed without fear and will stand the weather. The painted surface can be varnished if desired, painted or stencilled on. A glossy paint for indoor use can be produced by spraying the surface with a mixture of turpentine and wax and polishing it afterwards.

Casein adhesives. When dissolved in caustic alkalies or their salts, casein has adhesive properties and as such could be applied to the preparation of glues and cements, either liquid or solid, the solid glue only requiring to be dissolved in water for use. They find use for various industrial purposes, especially in wood work as they are ready for immediate use without previous soaking and heating as in the case of ordinary glue.

Two specimens are on exhibit, one prepared with borax and the other with soap. In one the borax serves as a preservative. The other requires the addition of an antiseptic as thymol or carbolic acid or lysol in order to preserve it.

Photographic films. Casein has been used in place of celluloid in the manufacture of photographic films, and in place of gelatin for coating the photographic plate or film, the sensitised "emulsion" in the latter case consisting of a solution of casein holding the halide salts of silver in colloidal suspension. Photographic paper similar in most respects to gelatine-chloride or bromide paper have also been prepared for printing from negatives or for enlargements.

The paper used for the specimen photographs on exhibit was obtained by coating ordinary paper with a solution of casein in citric acid to which a little glycerine had been added to give the paper the requisite pliability. The coated paper was, after drying in the shade, drawn over a 5% solution of ammonium chloride to render the casein insoluble, dried, sensitized in the dark room by floating in a 10% solution of silver nitrate and again dried in the dark room. Prints were obtained as on ordinary P. O. P., the operations of toning and fixing being also the same as with P. O. P.

Boot and shoe polishes. Casein has been found useful in the preparation of shoe and boot and furniture polishes, the casein in such preparations serving the purpose of a protective colloid holding in suspension considerable quantities of the other ingredients, usually wax or paraffin, turpentine and colouring matter. The samples exhibited have been prepared by dissolving casein in a solution of ordinary soap and incorporating with the mixture about twice the quantity of turpentine. A certain proportion of shellac dissolved in borax is also added to give the requisite gloss and finally the colouring matter which in the case of brown polishes may be an extract of

annatto and in black polishes, ordinary lampblack in a fine state of division.

Alimentary Casein. Casein being the chief protein material in milk is of considerable food value and possessing as it does good keeping qualities and no objectionable taste or smell has found favour in the preparation of several alimentary products, some of these being peculiarly suited for invalids. Thus, patent foods have from time to time been placed on the market under the names, Plasmon, Eucasein, Vitafer, Sanagen, Sanatogen, etc. The composition and the process of manufacture of these are not known with certainty but from knowledge gained by their chemical analysis it is possible to imitate them closely. Thus a product similar to Plasmon which is a soda compound of casein is obtained by mixing together 80 parts of casein containing about 5% of fat, 7 parts of sodium bicarbonate and 13 parts of lactose. Eucasein, which is a casein ammonia compound, could be prepared by passing ammonia through casein suspended in alcohol and afterwards separating and drying the casein. A product closely resembling Sanatogen is obtained by dissolving casein in sodium glycero-phosphate, evaporating the viscous mass to dryness in vacuo and reducing the dried mass to fine powder. Samples of these products obtained in the manner above mentioned are on exhibit.

Casein solids—Galalith. By suitable treatment casein could be converted into a plastic mass which could be moulded or pressed into various shapes, the finished product resembling horn, ivory, or tortoise shell according to the manner of treatment. The products are known as Galalith or Lactoform. The plastic mass after being hot-pressed in hydraulic presses is hardened by immersion in a solution of formaldehyde the length of treatment varying from 2—30 weeks, according to the thickness of the articles. A variety of articles can be made from Galalith, e. g., brush backs, combs, cigarette holders, electrical fittings, umbrella and stick handles, buttons, etc. The articles thus made are uninflammable unlike celluloid.

Lactose. The whey drained off the curd in the manufacture of cheese contains most of the lactose present in the original milk and could be recovered. The method adopted consisted in first precipitating the milk albumen present in the whey by the addition of acetic acid and warming and then removing it by straining through cloth. The clear liquid was evaporated down on the water bath until the liquid showed signs of turning brown after which it was concentrated in vacuo until a syrup was obtained from which the sugar crystallised out on cooling. The first crop of crystals was quite white after having been washed in a fine spray of water. The mother liquor on treatment with bone charcoal and concentration in vacuo yielded a further quantity of brown coloured crystals.

OCCURRENCE OF STERILE PLANTS IN BENGAL GRAM (*Cicer arietinum*).

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At the Cotton Breeding Station, Coimbatore, a few sterile plants (Plate I, Fig. 1) without any pods were observed in the year 1930, among the progenies of single plant selections. During 1931, their appearance was more common, and again in the following season, their percentage occurrence was as high as fifteen in certain fields sown with unselected bulk. As the presence of such a large proportion of sterile plants would considerably reduce the yield of crop, a detailed study of these sterile plants was made with regard to the modifications of their floral parts, and the causes of their occurrence.

The sterile plants (Fig. 1) had their floral parts metamorphosed or virescent, and were distinguished by their characteristically stunted and bushier habit, by the smaller and more greenish leaflets, and by the upright gynophores with empty carpels. Sometimes a plant had only a few branches, or portions of a branch displaying this abnormality. The various monstrosities observed in the flower, might now be dealt with under the various types of floral structures.

Sepals. The gamosepalous calyx was transformed into five separate stalked leaves with entire margin (Fig. 2) inserted in a radial symmetry on the receptacle. In advanced cases, each of the sepals was modified into a pinnate leaf (Fig. 3) with long petioles and serrate edges.

Petals. The corolla lost its pink colour and showed different degrees of virescence (Fig. 3). In such cases the normal Zygomorphism, and hooded character of the standard remained unaffected. In others the differentiation between sepals and petals was lost, and both whorls were metamorphosed into pinnate leaves. In a few instances there was pelory.

Stamens. The diadelphous stamens got dissociated and remained free (Fig. 3). The filaments showed either petalody (Fig. 4), or phyllody with glandular hairs (Fig. 5). The anthers were often transformed into virescent cup-like structures, but if present, they were atrophied and non-dehiscent. In extreme cases the entire androeceum showed metamorphosis into pinnate leaves. (Fig. 7).

Pistil. The most common feature was the grooved petiole-like gynophore terminating in a partially developed carpellary leaflet with a tailed midrib corresponding to the style and stigma (Fig. 2). In some cases the entire pistil had changed into a pinnate leaf (Fig. 3). The funicle showed tendencies to form a bilobed leaflet with prominent glandular hairs. The ovule too was found to be transformed into a leaf (Fig. 6).

Fig. 2. Fig. 1. Fig. 3.

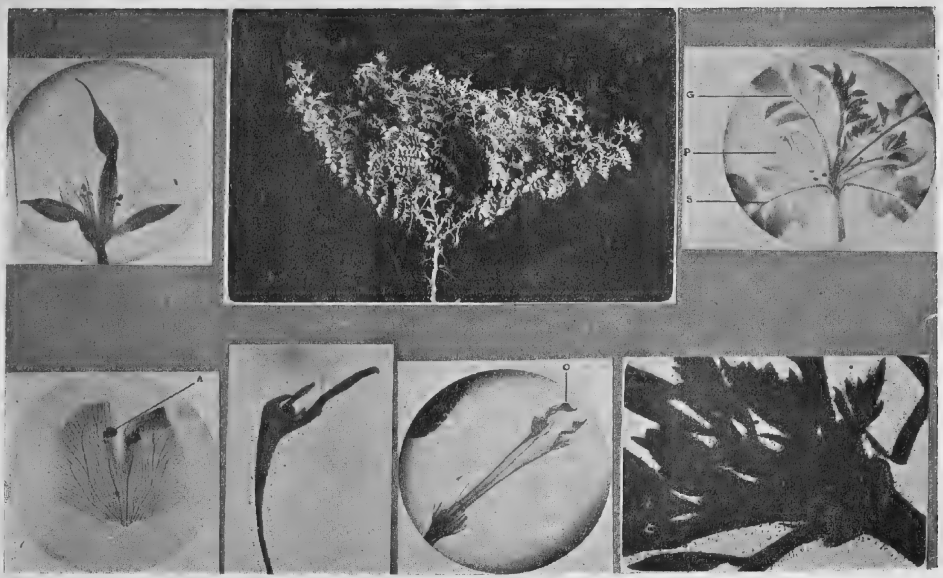

Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Plate I. Fig. 1. An abnormal plant with prominent gynophores.

Fig. 2. Longitudinal section of an abnormal flower. Sepals changed to stalked leaflets, stamens free, Pistil, turned to leaf.

Fig. 3. Do. Do. (S) Sepals; modified into pinnate leaves. (P) Petals. Stamens free. (G) Pistil turned to a pinnate leaf. Shows axillary profiforation.

Fig. 4. Petalody of the filaments opposite to the standard. (A) Anther.

Fig. 5. Stamens exhibiting leafy nature: anthers showing cup-like modifications and development of glandular hairs.

Fig. 6. (O) Ovules and funicles showing leafly transformations.

Fig. 7. All floral members transformed to leaves.

In one plant an interesting monstrosity with all the various floral whorls converted into pinnate leaves (phyllomania) was met with (Fig. 7). In this case a vegetative shoot was found in the axil of the carpel, thus showing axillary proliferation.

Causes. Worsdell (1916) stated that the phenomenon of abnormalities is generally caused "under certain unfavourable conditions of climate, nourishment, or the influence of parasitism" of a fungus or an insect. Janse (1928) explains the same to be due to the disturbances produced in the quality or quantity of the growth enzymes occurring in the plant. The abnormal plants were examined by the Government Mycologist and the Entomologist, Coimbatore, and no sign of fungus or insect attack was detected. Seeds collected from such plants when sown did not produce a greater number of abnormal plants (11·7%) than was noted in the adjoining control area. The continued presence of sterile plants in crops raised during all the three years under observation, precludes one from declaring the climate as the causal factor, as the three years were varied in their characteristics. By elimination, the stimulus responsible for this phenomenon may either be the presence of any virus or purely physiological. Cross inoculations were tried on a small scale, but they failed to produce any results. Further studies into the causes of this transformation are in progress.

It may be mentioned here, that the abnormal plants bore a larger number of root nodules. It is very likely that this feature is the sequel of protracted vegetative phase exhibited by these plants. The presence of an excess of carbohydrates might have stimulated the bacteria to become more active and to produce more nodules.

Worsdell, after an elaborate presentation of teratological data, concludes that the process of Differentiation of floral members is a reversionary phenomenon while their Simplification is an evolutionary event. If the teratological features portrayed above are analysed, the dissociation of the calyx and androecium will be grouped under dialysis. The production of gynophores and the development of shoot at the carpellary axil are only examples of median and axillary proliferations. The phyllody of the calyx, corolla, pistil, funicle and ovule, and petalody of the stamens are different types of metamorphosis. As these are only different phases of Differentiation, they are to be interpreted that they are reversionary in character, and that they go to prove the foliar origin of the several floral members.

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A NOTE ON THE OCCURRENCE OF SMALL OUT-GROWTHS ON THE CALYX RING OF THE COTTON FLOWER

By C. JAGANATHA RAO, B. A.,

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The author of this note has observed for the past four seasons (1929—'33) some peculiar out-growths or organs on the calyx ring of flowers produced in one of the pure lines of cotton, No. 54, a 'Northerns' Selection (*Gossypium indicum*) grown on the Agricultural Research Station, Nandyal. A fair percentage of flowers produced by this culture were found to have these organs, three in number and about two or three millimeters long when fully developed. Sometimes, only two, also one, either fully developed or in a rudimentary stage have been noticed in the flower. These structures spring from the outer base of the calyx ring and are situated one opposite each of the three bracts. Their shape is either conical, ovate or obovate and often they are cup-shaped, the hollow orienting towards the bract and away from the calyx. Rarely, the organ occupies the entire height of the calyx ring and looks as though the proximal ends of two of the sepals of the calyx have reflexed outwards and given rise to each out-growth. The tissue of this supernumerary structure resembles that of the gamosepalous calyx ring—yellowish-green in colour and dotted with black glands so characteristic of the cotton plant—in contradistinction to the dark reddish-green involucre, also full of black glands in the tissue.

Robbins in his text-book (1) mentions the occurrence of intracalcicary organs in upland cottons i.e., organs arising between the Calyx and Corolla and also observes that Cooke and Meade regard them as "Supernumerary calyx lobes or as representing free stipular elements of the calyx lobes."

Morphology of these structures apart, their presence serves as an ancillary distinguishing character for the culture.

In the F_1 of courses involving this strain, this character has been observed to be partially dominant.

Reference.

1. Robbins. Botany of crop plants.

A SUGARY EXUDATION FROM SORGHUM

BY Dr. T. R. SESHADRI, M. A., Ph. D.,

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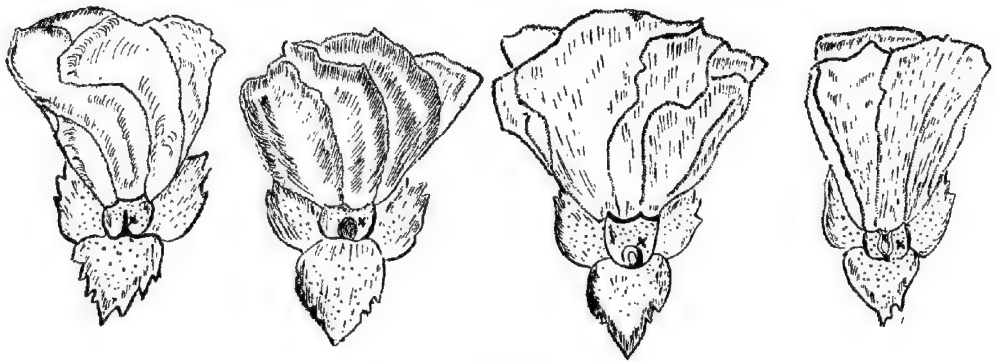
In a variety of sweet sorghum called *Tella Jonna* commonly grown in the Bellary district a sweet fluid is found to exude from the ear-head of certain plants from the beginning of the flowering season. It

OUTGROWTHS OF DIFFERENT SHAPES ON THE CALYX RING



SHOWN BY THE SIDE OF × MARK

frequently collects and dries on the leaves and is the cause of attraction for the large number of ants and other insects that visit the plants. Usually it is found as a sticky semi-solid; in several cases however, crystals are formed. When this secretion takes place the ear-head remains small and undeveloped though in all other respects the plant may look normal.

T_1 is a strain which yields this secretion in abundance; T_{12} also gives some quantity of it. The sorghums grown in Coimbatore such as *Periamanjal* do not exhibit this phenomenon so markedly. The juicy nature of the variety and the setting in of the cold weather during the flowering stage seem to be the conditions favouring the production of the exudation. In Bellary district flowering takes place in the coldest part of the year and *Tella Jonna* is sweet and juicy. In Coimbatore this condition is not seen in the summer cholam and even during the main season it is occasionally observed only in certain late varieties and in some of the late side shoots. It is noticed that with the *Tella Jonna*, manuring with cattle manure, green manure or mineral manure which gives rise to a good vegetative growth also renders the plants more susceptible to this condition. Further, insects are found to be most prominent in the plants producing this exudation.

Samples of the secretion in a solid form were collected from *Tella Jonna* (T_1) in the Hagari Agricultural Research Station during two seasons – on 30—12—'31 and 24—1—'32 in the season 1931-'32 and on 20-1'-33 during the season 1932-'33. They were obtained by gentle scraping with a spatula or knife so that very little of the plant tissues was included. It was noticed that the January samples were much more crystalline than those taken in December. They were brought in stoppered bottles to Coimbatore laboratories, dried for a week in a desiccator over concentrated sulphuric acid and analysed. At this stage they were a little sticky and hygroscopic and had the smell and taste of jaggery.

By the iodine test aqueous solutions of the samples were found to contain no detectable amounts of starch or dextrin. The following table summarises the results of analyses of the samples.

Date of sampling.	Acid content as C. C. of N. NaOH for 100 g of sample.	Ash %	Total Sugar %	Reducing Sugar %	Sucrose %
30—12—31	7·75	1·36	80·4	23·5	56·9
24—1—32	8·20	1·53	79·0	14·3	64·7
20—1—33	8·60	1·49	80·6	17·8	62·8

The reducing sugars consisted of glucose and fructose only and pure sucrose could be isolated from the samples by repeated treatment with 82% alcohol containing acetic acid and subsequently washing with

rectified spirits. When examined under the microscope a fresh sample of the exudation was found to contain yeast along with plenty of bacteria. A 5% aqueous solution when fresh had a pH of 5·5, after 24 hours 3·5, and after 48 hours 3·2. The total acid content increased 15 times when the solution was allowed to stand for 48 hours. The bulk of the organisms increased rapidly; very little alcohol could be found, the fermentation leading mainly to the production of acid. No fungus spores could be detected and this was kindly verified by the Government Mycologist at Coimbatore.

It should be noted that the percentage of the reducing sugars is high, that it decreases with the advance of the season, and that, there is a corresponding increase in the sucrose content. The results are similar to those obtained for the juice of the sugary sorghums by Annett (Bull. No. 41 of the Imperial Agricultural Research Institute, Pusa). It may, therefore, be concluded that the exudation is simply the flowing out of the sorghum sap. What should have gone to fill up the grains and be transferred into starch is poured out as a sugary fluid. But the exact cause of it is not yet clear.

Help from the Farm Manager, Hagari Agricultural Research Station, in the collection of the samples of the sugary exudation is gratefully acknowledged. This work was done when the author was working in the Agricultural Research Institute, Coimbatore.

Correspondence.

1. A locally made and improved type of Wind-mill.

Mr. S. V. Doraiswamy B. A., B. Sc. Ag. writes from Udumalpet:—

In Mr. Subba Rao's garden about 3 miles from Udumalpet on the Thalli road, an ingenious kind of windmill has been erected and is giving very satisfactory results. Mr. Subba Rao's son Mr. Krishna Rao, M. A., B. L., under whose supervision the garden is being cultivated, has been responsible for its erection. It is interesting to note that Mr. Krishna Rao has taken up for cultivation under his supervision about 25 acres of garden which includes about 6 acres on lease. This is probably the first instance when a highly educated gentleman has taken up the position of a tenant and cultivates land on lease in addition to his own. The gardens are mainly devoted to sugarcane growing and there is an oil-engine and pump fitted to one of the wells. Being a Physical Science graduate Mr. Krishna Rao has utilised his knowledge to erect a cheap, simple and efficient type of windmill, the total cost of which is about Rs. 250.

The mill consists of a fan made locally of iron plates and attached to the central shaft of a condemned motor lorry differential, and coupled to a wooden fly-wheel attached to the back axis of the chassis, the wheels having been removed. A brake arrangement has also been made using the brake drum. The fly-wheel is attached to a rotary pump of two-inch delivery by means of belting. The cost of the pump and connected pipes comes to Rs. 150. The cost of the other parts may not exceed Rs. 100, including the cost of the lorry chassis. The six supporting posts are the frames of the chassis. All the parts work on ball bearings. The following are the dimensions of the windmill, discharge etc

TWO VIEWS OF THE WIND MILL IN ACTION

Height of Fan axis from ground—12 feet.
(it is proposed to raise this height to 20 feet soon)
Diameter of Fan—10 feet. Discharge—over 1500 gallons per hour.
Irrigates about 30 to 50 cents a day.

Note. Mr. Krishna Rao is contemplating to effect some improvements which will increase the efficiency and power of the mill. There is strong westerly breeze for six months from about May and easterly winds for two months from October.

II. Wild Life in Southern India.

(We have received the following from the Collector of Coimbatore, for publication in our Journal—*Ed M. A. J.*)

Amongst the many and great changes which have been taking place in India during recent years there is one which is not commonly known and which, if it were realized, would excite the sympathy of all right-minded people. The change referred to is that which has taken place with regard to the destruction of wild animals, chiefly in order that their meat may be sold to enrich people who have no consideration for the lives of any living craatures in the wild state. No doubt Providence provided many of the wild animals for the use of Man and until recently in India, Man used this gift wisely. Nowadays, however, the march of civilization which has brought the motor car, electric torches and cheap fire arms has made the destruction of Wild Life so much more easy than it used to be that unless Public opinion is stirred up to put a stop to the ruthless destruction that is going on, a time will arrive at no distant date when many species will cease to exist. What is happening in Southern India is also happening in other parts of the world. In several countries the Public have become alive to what is going on and have decided that unscrupulous people must not be allowed to make money by going about at night with electric lights or in cars, shooting any wild animals that they may see, including females and young ones. In these countries Societies have been formed in order to take steps to put a stop to the indiscriminate destruction of Wild Life and to help the Government in enforcing the existing laws. There is no doubt that Southern India should not be backward in following so admirable an examples and it is understood that His Excellency the Governor of Madras intends shortly to invite all those interested in preventing the wholesale slaughter of our wild animals to attend a public meeting in Madras, over which he will preside, with the object of forming a Society for the Preservation of Wild Life in Southern India. It is sincerely to be hoped that all those who read this will make a point of discussing this new and very interesting subject with their friends and that as many as possible will attend the meeting and join the Society.

An appeal to Landowners. In almost all countries of the world there has in recent years been an awakening of public interest as to the urgent need of adequately protecting Wild Life in all its aspects.

India has up to the present time been backward in this matter, for outside the Government forests birds and beasts of the field have been looked upon as fair game to all those who have been able to shoot or snare for sport or for profit. Neither sex nor age has been spared, and breeding seasons have been entirely disregarded.

Within Government forests shooting has for the past fifty years or so been restricted by licence; but there are many who carry on the slaughter in these areas also, for it is not easy to detect offenders.

Now is the time. The time has now come when, if the present generation does not speedily realize—or realizing ignores—the fact that the heritage of Wild Life received from previous generations is being woefully squandered, many

species of birds and animals will become extinct. Once the number of any species has been reduced to a certain low ebb the end is at hand; for Nature has been interfered with, and a greatly diminished species cannot survive against the many natural enemies—The tigers and the cats, the eagles and the hawks devour them; the mongooses, the lizards and the snakes prey upon the eggs and the young.

The Landownsr is responsible. Who are the men of the countryside of fifty years of age who can say that Wild Life in their own neighbourhood has not greatly diminished since the days of their youth? And whose is the blame?

All the world over the Wild Life on the land is the property of the owner of the land, and his is the responsibility He cannot say that it is his to do what he likes with, for he is responsible to The Creator of all things to preserve that which has been created. He must not allow Wild Life to be persecuted to extinction.

A man will not suffer his flocks and his herds, his fowls and his pigeons to be raided and destroyed. There is greater reason to safeguard and protect the wild animals and birds, for his cattle and sheep he can replace, but Wild Life once gone can never be replaced.

So let us hope that this appeal to Landowners great and small will cause them to take thought to the future, realize the danger that is here plainly before their eyes beyond any question or dispute, and bestir themselves to take action before it is too late to preserve the Wild Life for which they are responsible.

A Society for the Preservation of Wild Life. In the United Provinces of India a Society has been formed for the Preservation of Wild Life, and it is understood that his Excellency the Governor of Madras intends shortly to invite all those interested to attend a Public Meeting in Madras, over which he will preside, with the object of forming a Society for the Preservation of Wild Life in Southern India.

All owners of Land are interested. What owner of land is there who, having read the above, can say he is not interested? All ought to endeavour to attend, or be represented, and all should now take action; for every day of delay means the lives of animals and birds which should be preserved.

Notes & Comments

1. **University Degree for Veterinary Science.** As already referred to in our last issue, the subject of affiliating the Madras Veterinary College to the local University, and bringing up the standard of studies in that Institution for a University degree in Veterinary Science came before the Academic Council and the motion was accepted for instituting a degree B. Sc. (Veterinary) and recognising the Veterinary College, Madras as an Institution for preparing students to that degree. There has been a demand for a better class of Veterinary Surgeons and this question arose on the initiative of the Director of Veterinary Science. We congratulate our sister College on this recognition.

2. **Another Agricultural Colony Scheme.** We understand that two wealthy planters and miners of Vellore, Messrs Vas and Sinha, are about to inaugurate a scheme of agricultural colonisation in the Kulitalai Taluk of Trichinopoly where it appears they own an area of 2000 acres of cultivable land. Their idea seems to be to divide the area into small farms of 20 acres each. A superintendent for each would

be employed, and he would be from among the unemployed middle class South Indians, such recruitment being based on non-communal considerations but on suitability in each case. The projected colony, it is the hope of the proprietors, would be a small democratic unit of 100 superintendents with their families, living and moving freely without any distinction of caste, faith or nationality.

Besides agricultural activities in the colony, it is proposed to provide a school of cottage industries, a bank, a provision store, and a national emporium stocking all Indian-made goods, for the benefit of the colonists. A spinning and weaving establishment will also be a chief feature.

Profits earned in the colony will be distributed among those who reside in the colony only and only a small portion of it will be appropriated towards the administration charges and against the Rural Development Fund the management have created. An extensive practical programme for the development of the villagers is proposed to be carried out with the aid of the colonisers themselves. The venture appears to be a very ideal one and we offer our best wishes to the two gentlemen on their very laudable attempt.

3. Fish Culture in South India. We are glad to note that the Imperial Council of Agricultural Research have approved of a scheme formulated by the Agricultural Department of the Madras Government for development of rural pisciculture. In this presidency all irrigation wells, ponds and tanks have water only for part of the year, roughly for three to nine months; and in the course of their investigation, the Agricultural Department have urged the necessity for steps being taken to determine the kind of fish that could be grown in water sources which had supply only for limited periods in the year. They feel that the methods of cultivating fish in perennial sources do not apply to such ponds, wells and tanks. Just as different crops were grown on land, according as there was supply of water, it is possible, in their view, to rear varieties of fish crops, annual, wet and dry as the case may be.

The development of the art of pisciculture had not been seriously tackled in this country in the past due to the religious sentiment against growing living things in order to eat them. Such sentiment is now gradually disappearing as medical opinion is conclusive that rice is notoriously deficient in nutrition, if taken by itself. Further the Dietetic Commission in Japan has held that fish is the best corrective to rice.

The Madras Government have agreed to provide fish ponds, laboratories and lands and the Advisory Board of Imperial Council of Agricultural Research has recommended the sanction of Rs. 60,000 for experiment being conducted for a period of five years.

4. Wild Life Protection in North India. We invite the attention of our readers to a comment published elsewhere on this subject. Though late in the field it is commendable that people have begun to feel the need for the protection of wild life. The lion which was roaming wild in Sind and Cutch over two hundred years ago has been made extinct and it is only a question of time when the ibex, bison and other wild forms of life will share such a fate if something is not done in this direction. In the United States of America there are what are called National Parks in different parts of the States and in these places special attention is paid to the proper preservation and perpetuation of some of the remarkable creations of nature which are mercilessly driven to extinction by man's rapacity in various parts of the world.

ABSTRACTS.

Studies on Paddy Cultivation—ii. The effect of manures on the composition of the Paddy crop and Soil. A. W. R Joachim, S. Kendiah and D. G. Panditheseкere (The Tropical Agriculturist, Ceylon, 1935, Vol. 81, pp 11—35) In order to determine the optimum conditions of manurial and cultural treatment, which would secure most favourable results with paddy grown under the irrigated system of paddy cultivations under the soil and climatic conditions of Ceylon, a series of three experiments was started by the Ceylon Department of Agriculture. The first of these experiments carried out during the *Maha* 1931—32 and *Yala* 1932 seasons (October 1931 to September 1932) aimed at a statistical analysis of the intake of nutrients at different stages of growth, as influenced by different kinds of manuring. The second experiment being conducted during the *Maha* 1932–33 and *Yala* 1933 seasons will test the efficiency of different systems of cultivation as transplanting, broadcasting etc; with and without manuring; cost figures will also be kept in order to determine the most economic system to adopt. The third experiment to be carried out during the *Maha* 1933–34 and *Yala* 1934 seasons will investigate the question of the optimum time of application of fertilisers and also whether smaller doses of manure, one of which is to be applied just before flowering, would give better results than the application of one large dose at sowing. The most suitable phosphatic manure to be used for paddy will also be investigated.

The present paper reports the results of the first series of experiments where randomised plots 1/100 acre each, (triplicated 6 times) were treated with green manure (Tithoria diversifolia) at the rate of one ton per acre, superphosphate at the rate of one cwt, per acre, a broad ratio of ammonium phosphate at about 100 lbs. per acre, and a mixture of green manure and superphosphate at the above rates. A statistical analysis of the data obtained showed that—(1) The average percentage constituents of the *Maha* crop (duration 6½ months) are generally higher than those of the *Yala* crop (duration 4½ months) The *Maha* crop, at the stage of harvesting contained, for whole plants, 55·4 per cent. dry matter, 0·85 per cent. nitrogen. 12·0 per cent. ash, 0·30 per cent. phosphoric acid, 0·80 per cent. potash, 0·39% lime, and 9·00% silica. The *Yala* crop, on the other hand contained for whole plants at the stage of harvesting, 47·5 per cent. dry matter, 0·71 per cent. nitrogen, 15·0 per cent. ash, 022 per cent. phosphoric acid, 1·18 per cent. potash and 0·40 per cent. lime. The figures for phosphoric acid are much lower than those reported in Hawaii and other places, indicating the deficiency of Ceylon soils in phosphoric acid. The composition of the crop does not show much variation with treatment; the crop from the ammonium phosphate plot showed

however, markedly higher phosphoric acid content during the *Maha* season. (2) At the stage of flowering, only about 50 per cent. of the nitrogen and dry matter, ash and phosphoric acid and 78 per cent. of the potash and lime of the crop at harvest were absorbed during the *Maha* season. The corresponding *Yala* figures are much lower, only about 34 per cent. of the nitrogen, 26 per cent. of the phosphoric acid, dry matter and ash, and 35 per cent. of the lime and potash having been assimilated at the flowering stage. (3) Considering both *Maha* and *Yala* data, the grain at harvest contained 71 per cent of the nitrogen, 82 per cent. of the phosphoric acid, but only 21 per cent. of the lime and 12 per cent. of the potash of the whole crop. The straw on the other hand contained 86 per cent. of the potash, 78 per cent. of the lime, and only 15 per cent. of the nitrogen and phosphoric acid. (4) Worked on an average basis, the total constituents removed by the paddy crops cultivated during a period of one year (*Maha* crop about 2000 lbs, and *Yala* crop 1000 lbs grain per acre : straw about equal weight) are :—nitrogen 46·5 lb. ; phosphoric acid 15·6 lb. ; potash 59·9 lb. ; and lime 25·3 lb. (5) Soluble phosphoric acid applied in fertilisers is absorbed only to the extent of 20 to 25 per cent. of the quantity applied. The addition of phosphatic fertilisers caused no appreciable increase in the water—soluble phosphoric acid content of the soil. The possibility of "solid phase" feeding of phosphoric acid by the paddy plant is indicated In view of this possibility and of the conversion of soluble phosphates into insoluble compounds, the use of bonemeal for manuring paddy is suggested. (6) About 2/3 of the nitrogen with green manure and nearly all in ammonium phosphate was assimilated, as shown in the increased yield. From 75 to 85 per cent. of these constituents were absorbed during the *Maha* season. (7) Analysis of the soil showed heavy losses of fertilising constituents much above those absorbed by the growing crops. The losses were especially marked at the end of the *Maha*, and were arrested during the *Yala*, probably due to addition of crop residues. Decrease in organic matter of soil represented a loss of 2 tons carbon and 360 lbs. nitrogen (crop produced about 3 tons with about 50 lbs. nitrogen and 1·5 tons carbon). The carbon-nitrogen ratio of the soils remained in the neighbourhood of 11. (8) Exchangeable base determinations showed loss of all bases. The losses are greatest with exchangeable calcium which are present to the extent of about 72 per cent. of the total exchangeable bases (from 5·16 milli-equivalents to 4·45 m. eq. per 100 gm. soil), and are considerably higher than the amount absorbed by the crop. Exchangeable potassium was less by an amount equal to that absorbed by the crop. The exchangeable ammonia content decreased with the growth of the crop. (9) The pH value of the soils increased slightly on pH puddling (from pH 5·59 to pH 5·77), but diminished again with growth of the crop (to pH 5·40). (10) The phosphoric acid absorption data would appear to indicate that two or more small doses of soluble fertilisers might give better results than a single large application. (C. N.)

The vitamin B content of different samples of Indian rice by Spruyt's colorimetric method Part II :— H. W Action, S. Ghosh and A. Dutt (Indian Jour. Med. Research 1933, Vol. 21, pp 103—107). In a previous paper (Ibid, 1933, Vol. 20, No. 3), the authors had reported the vitamin B assay of samples of rice obtained from rice mills or dealers round about Calcutta. The present paper reports assays of samples of paddy with white (silver skin) and red pericarp, secured from the Government Agricultural Department, Bengal and milled under standard conditions. The treatments compared were, hand hulling (*dhenki* rice, prepared by boiling the samples in earthern pots and hulling by hand in a *dhenki*), parboiling, milling, polishing, and preparation of "*atop*" rice (sun drying and milling). The Vitamin B content was determined by Spruyt's colorimetric method and feeding experiments were also carried out with *munia* birds (*Munia maja* and *Munia* Cucogastroides) available in the local market. Some of the

interesting points brought out by the comparative study were:—(1) parboiling conserves the vitamin B. content and protects it from appreciable loss even on subsequent milling. But *polishing* of such parboiled, milled rice, (with French chalk for several hours) and *washing* in running water (for 48 hours) were highly detrimental to the vitamin content. Thus parboiled white rice once hulled (milled) showed a colour index of 197·14, while twice hulling reduced it to 164·65, polishing to 121·55 and washing to 34·0. (2) *Dhenki* rice (hand hulled) was superior to machine-milled rice and parboiled rice superior to "*Atap*" (sun dried, milled rice) sundrying, obviously has a harmful effect on vitamin B. content and this was confirmed by feeding trials, wherein *Munia* birds fed on parboiled-machine-milled rice, continued to live on the 30th day, while those fed on milled "*atap*" (sun-dried) rice mostly died. (3) There was not much appreciable difference in vitamin B. content between the rice samples with white and red pericarps which were examined in the present study. (C. N.).

Pests of Garden Plants:. *The root eating ant. Dorylus orientalis. Westw* (Tropical Agriculturist, vol. 80, p, 276). The workers live underground, and hence their presence is not detected until the plants begin to wilt. As it is difficult to exterminate them without injuring the plants, when once the colony gets established, a method of applying petrol is suggested both as a remedy and as a preventive. One to two pints are sufficient for thirty square feet and can be applied in shallow furrows and covered. Two days before planting, the area can be treated with saw dust or woodashes steeped in carbolic disinfectant, at the rate of two tablespoonfuls for every bottle of water. If the attack is detected after the planting, petrol can be poured round the plant at distances of six to nine inches, and covering with wet earth. The dead plants must be pulled out. (R. B.)

The Branching of Egyptian Cotton Plants. (Ministry of Agri. Egypt. Tech. and Sci. service. Bot. section Bull. 87). The author working with Egyptian variety finds that an accessory bud if it develops, gives rise to only a sympodium, while an axillary bud may produce a monopodium or a single flower, depending upon the time of development of the corresponding accessory bud. The main stem of an Egyptian cotton may be divided into four well defined zones and the number of internodes composing such zones varies with variety. Cutting off monopodia or apical bud (topping), forces the development of axillary and accessory buds. The significance of the branching habit may be seen from the relation between the yield and the position of first sympodium. A monopodial type is late and suffers from pink boll-worm attack. An ideal type for Egypt is one having monopodia at the axils of the cotyledons, or the next higher node. The flowering curve of such a type would rise more rapidly and reach a higher maximum than the present varieties and the flowering period being shorter, would suffer less from bollworm. (R. B.)

The Natural crossing of cotton flowers in Egypt. (Ministry of Agri. Egypt. Tech. and Sci. Bulletin No. 89). Under Egyptian conditions the authors find that there are seasonal variations in the percentage of vicinism, due mostly to the habits of pollen-carrying insects. The maximum vicinism occurs during the first picking and falls to a half later. The use of the late-picked seeds lowers the percentage of rogues. The percentage contamination varies with the nature of the source viz. line front or a point source. The incidence per ovule at the time of maximum vicinism is found to be one per thousand at a distance of one hundred metres. The product of vicinism and the square of the distance is a constant for a single rogue up to a distance limit. Long distance jumps from one field to another are yet puzzling. The need for belting is apparent. The economical use of pure material raised from plants grown under cages, and the sowing of successive generations in a concentric lay out, the crop of one year being protected by a belt of the crop from the seed of the previous year, are

imperative for the maintenance of a pure crop. Unless such elaborate care is taken, a variety may easily run out. (R. B.)

Perennial cultivation of cotton with special reference to the cultivation of ratoons in Egypt (Ministry Agri. Egypt Tech. Sc. Series, Bulletin No. 75). Experiments conducted to compare the ratoon and first year cotton plants on their relative merits of flowering, yield, quality and insect damage are described. The ratoons are earlier and steeper in flowering. The crop arrives on the market a week early and commands a better price for its quality. The effective flowering period being shorter, the ratoons escape the bollworm damages. The yields are variable and mostly depend upon the varieties ratooned. Certain seasonal disadvantages point towards the successful raising of ratoon cotton, in water-logged places in preference to first year plants. The quality of first and second picking is definitely better than that of the first year crop. The ratoons suffer less from the insect pests and do not carry the insect pests over winter in Egypt. Resting larvae of pink bollworm are fewer in ratoon except for the third picking, which is usually very small in quantity. For the above reasons it would be profitable from an entomological view point, to raise ratoon and first year plants throughout the country in alternate years. This would give a shorter and a longer close period in alternate years between two cotton crops. (R. B.)

Gleanings.

Limit of Sugarcane Yield. Dr. Prinsen Geerligs has recently stated that during the last 10 years, the production of sugar per acre has increased in Java by 30 per cent., and in Hawaii by 50 per cent. Similar increases have been obtained in certain other sugar-producing countries, such as Formosa and the Phillipines. It is possible to calculate the theoretical limit to increased production, assuming that the nitrogen content of sugarcane is 0·084 per cent. of the weight of the whole plant (as it is in P. O. J. 2878 and H. 109). Results of this calculation (which is based on the Mitscherlich law of growth) indicate that the maximum possible yield of such sugar-cane varieties is about 160 tons per acre, or about 25 tons of sugar per acre. These yields may be obtained only when the supplies of water and of plant nutrients are adequate, and when other environmental growth conditions are fully satisfactory. Several plantations in Hawaii have already recorded yields approximating to the theoretical limit, so that suitable modifications of the environment may yet lead to increased yields in other regions. The theoretical 160 ton maximum, is based on the assumption that the nitrogen content of the cane is 0·084 per cent. Since yielding ability is inversely proportional to nitrogen content, it would appear possible to exceed the 160 ton per acre limit, by breeding new sugarcane seedlings containing less than 0·084 per cent. nitrogen; the practical limit evidently has not yet therefore been obtained. (*Tropical Agriculture, Trinidad, August 1933*).

Soybean flour. A new type of flour, made from soybeans, is said to combine whiteness with a complete absence of the characteristic disagreeable soybean odour and flour. The patented process of manufacture removes all but 1·7 per cent of the oil from the soybean. The protein content is 68 per cent. The flour called "Nusoy" is finely ground and may be used in white bread and other baked goods, in sausage, bologna, wieners, macaroni, and other products where water absorption and retention are important. When used in bread, 2 to 3 per cent. increases the protein content of the bread appreciably. And the bread has a good appearance, is tasty and remains fresh unusually long. For diabetic bread, the baker uses Nusoy to the extent of 9 per cent. with gluten flour to give an almost starch-free loaf containing double the protein content of ordinary white bread. The high absorption ability of the flour effects a 10 per cent. increase in the number of loaves, it is asserted. (*A. E. B. in Scientific American, July 1933.*)

Crop & Trade Reports.

Cotton Crop, Madras, 1933—34, First Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1931—'32, has represented 9·0 per cent. of the total area under cotton in India.

2. The area under cotton up to the 25th July 1933 is estimated at 176,500 acres. As compared with the area of 210,600 acres estimated for the corresponding period of last year, there has been a decrease of 16 per cent.

3. *Central Districts and South—mainly Cambodia Tract.*—The area in the Central districts and the South represents the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 137,100 acres to 115,500 acres, i.e., by about 16 per cent. The yield is expected to be below normal due to the want of sufficient showers in June.

4. *Deccan or Northerns and Westerns tract.* In Bellary, where the early crop is sown in June, the area rose from 22,500 to 28,000 acres owing to the good rains received in May. In the other districts the area has fallen owing to the inadequacy of timely rains.

5. *Cocanadas tract.* There has been a decrease in the area in Guntur and Nellore due to the insufficiency of timely rains.

6. The wholesale price of cotton lint per Imperial maund of 82 & 2/7 lb., as reported from important markets towards the close of July 1933, was about Rs 18—10—0 for Cocanadas, Rs 16—14—0 for red northerns, Rs 18—2—0 for white northerns, Rs 16—7—0 for (early crop) westerns, Rs 25—4—0 for Cambodia, Rs. 23—2—0 for Coimbatore karunganni, Rs. 24—11—0 for Tinnevelly karunganni and Rs. 20—13—0 for nadam. *(From the Board of Revenue, Madras).*

Groundnut Crop, Madras, 1933—34, Second Report. *Summer crop—Area and yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Presidency during the five months of January to May 1933 is estimated at 74,800 acres. Compared with the area of 67,700 acres estimated for the corresponding period of last year, there has been an increase of 10 per cent. The crop has been harvested in most places. The yield is reported to be below normal in Nellore, Chittoor, North Arcot and Trichinopoly. The total yield is estimated at 66,500 tons of unshelled nuts as against 69,400 tons during the corresponding periodof last year.

2. *Early crop—Area and yield.* The area under the early crop of groundnut (mostly unirrigated) up to the 25th July 1933 in the districts of Salem and Coimbatore is estimated at 168,000 acres. Compared with the area of 159,000 acres estimated for the corresponding period of last year, there has been an increase of 6 per cent. The want of timely rains has delayed the sowings for over a month in the district of Salem. The condition of the crop is good. The total yield is estimated at 84,000 tons of unshelled nuts as against 79,500 tons estimated for the corresponding period of last year.

3. *Price.* The wholesale price of groundnut, shelled, per Imperial maund of 82 & 2/7 lb. towards the close of July was Rs. 4—14—0 in South Arcot and Rs. 3—11—0 to 3—14—0 in the other districts. *(From the Board of Revenue, Madras).*

Sugarcane Crop, Madras 1933, First Report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1931—33 has represented 3·6 per cent of the total area under sugarcane in India.

2. *Area.* The area under sugarcane up to the 25th July 1933 is estimated at 103,740 acres. The area estimated for the corresponding period of last year was

103,930 acres. There has been a large decrease in the districts of Anantapur, South Arcot, North Arcot and Trichinopoly, which has been partly made good by an appreciable increase in the Circars and Bellary.

3. *Condition.* The condition of the crop has been satisfactory except in the Districts of Chittoor, South Arcot, and North Arcot where it has been partly affected by want of sufficient rains.

4. *Price.* The wholesale price of jaggery per imperial maund of 82 & 2/7 lb. towards the close of July was Rs. 3—8—0 in Vizagapatam, Rs. 6—0—0 in Erode (Coimbatore) Rs. 3—5—0 in Vellore (North Arcot) and Rs. 4 to 4—8—0 in the other important districts. (*From the Board of Revenues, Madras).*

All India Final General Memorandum on the Wheat Crop of 1932—'33. The total area reported is 32,992,000 acres, as against 33,803,000 last year, or a decrease of 2 per cent. The total yield of the crop, which has already been harvested is estimated at 9,452,000 tons (44,109,000 quarters of 480 lbs. each) as compared with 9,024,000 tons (42,112,000 quarters) last year or an increase of 5 per cent.

Provinces and States.	Area (1000 acres).		Yield (1000 tons).		Yield per acre in lbs	
	1932—33	1931—32	1932—33	1931—32	1932—33	1931—32
Punjab.	9,927	10,392	3,255	3,152	734	679
United Provinces.	7,789	7,864	2,744	2,633	789	750
Central Provinces & Berar.	3,553	3,628	670	693	422	428
Bombay.	3,161	2,835	782	592	554	468
Central India.	2,068	2,189	340	339	368	347
Hyderabad.	1,331	1,367	168	161	289	264
Rajputana.	1,268	1,508	355	364	627	541
Bihar & Orissa	1,235	1,221	492	449	892	860
N. W. F. Province.	1,012	1,014	237	250	525	552
Gwalior.	1,394	1,492	319	297	513	446
Baroda.	74	72	31	21	933	653
Delhi.	42	41	11	9	587	492
Ajmer—Merwara.	22	31	6	9	611	650
Bengal.	143	145	41	34	642	525
Mysore.	3	3	1	1	463	361
Total ...	32,992	33,803	9,452	9,024	642	598

It will be seen that the present estimates of yield as compared with the final figures of last year show an increase in all the important wheat—growing areas except in the Central Provinces and Bihar, Northwest Frontier Province and Rajputana. The yield per acre in the present season is 642 lbs, as compared with 598 lbs. last season. In addition to the areas for which particulars are given above, the crop is grown in certain other tracts (Burma, Madras, Kashmir and Benares State) from which no reports are received, and the average area under wheat in these tracts for the last five years has been estimated at 563,000 acres with a yield of 161,000 tons. (*The Indian Trade Journal, August 10. 1933).*

First Cotton Forecast, All India, 1933—34. This forecast is based on reports on the condition of the Cotton crop at the end of July or early August, and relates to about 77·5 per cent of the total area under the crop The area sown is at present estimated at 14,031,000 acres as compared with 13,413,000 acres (revised) at the corresponding time of last year, or an increase of 5 per cent. Weather conditions at sowing time were not quite favourable, and the present condition of the crop, is on the whole, reported to be fairly good. (*Indian Trade Journal August 24. 1933)*

First Sugar-cane Forecast, All India, 1933—34. This forecast is based on reports received from areas containing about 95 per cent. of the total area under

sugarcane in India. The total area planted with sugarcane this year is estimated at 3 349.000 acres, as against 2,982,000 acres at this time last year, or an increase of 12 per cent, the increase being mainly in the United Provinces (139,000 acres) Bihar and Orissa (158,000 acres) and the Punjab (35,000 acres). Bengal shows an increase of 21,000 acres, while the area in Madras remains stationary at 104,000 acres. Weather conditions at the time of planting were favourable, and the present condition and prospects of the crop, on the whole, are reported to be generally good. *(Indian Trade Journal, August 24,1933)*

First Groundnut Forecast, All India, 1933—34. This forecast is based on reports received from the three Provinces of Madras, Bombay and Burma and the State of Mysore, which together contain over 86 per cent. of the total area under groundnut in India. The total area, so far reported, is estimated at 2,080,000 acres as against 1,681,000 acres reported at the corresponding time of last year. Excluding the area for Mysore which is not available for the last year the present estimate of area shows an increase of 15 per cent. Weather conditions at sowing time were not quite favourable, but the present condition and prospects of the crop, on the whole are reported to be fairly good, *(Indian Trade Journal August 24, 1933)*.

Weather Review (AUGUST—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	9·6	+2·3	26·8	South	Negapatam	2·9	−0·6	12·8
	Berhampore *	9 3	+0·1	34·3		Aduthurai *	2·0	−1·3	10·9
	Calingapatam	4·0	−2 9	26.2		Madura	10·5	+6·2	21·4
	Vizagapatam	2·4	−2·7	11·8		Pamban	1·7	−0·1	5·9
	Anakapalli *	4·7	+1·1	24·3		Palamkottah	0·4	−0·1	14·0
	Samalkota *	3·8	+0·4	16·3		Koilpatti *	2·7	+0·8	9·2
	Cocanada	3 5	−2·1	15·1					
	Maruteru *	...	...	...					
	Masulipatam	5·8	−0·4	2 ·7	West Coast	Trivandrum	7·2	+3·1	88·5
						Cochin	20·0	+7·7	123·1
						Pattambi *	...	...	...
Ceded Dists.	Kurnool	4·9	−0·2	14 0		Calicut	16·3	+1·0	133·1
	Nandyal *	9·3	+5·4	22·1		Taliparamba *	22·7	−6·1	150·2
	Bellary	11 0	+8·9	21·6		Kasargode *	17·1	−7·9	138·7
	Hagari *	10·5	+9·5	15·9		Nileshwar *	17·6	−8·5	118·8
	Anantapur	12·2	+9·5	21·0		Mangalore	14·2	−9 0	130·3
	Cuddapah	6·3	+0·6	14·5					
Carnatic	Nellore	3 5	+0·4	7·0	Mysore and Coorg	Chitaldrug	7·8	+5·0	19·5
	Madras	3 0	−1·5	7 8		Bangalore	10·2	+4·9	26·7
	Palakuppam *	3·6	−1·0	16·0		Mysore	8·9	+5·6	27·5
	Palur *	4 4	+1·3	25·2		Mercara	28·3	+2·6	123·7
	Cuddalore	3·1	−2·3	20·5					
Central	Vellore	8·6	+2·8	13·3	Hills.	Kodaikanal	14·4	+5·8	42·5
	Salem	9·3	+2·8	22·2		Coonoor *	8·5	+4·7	29·5
	Coimbatore	2·4	+1·3	10·5		Kallar *	8·0	+5·4	29·5
	Coimbatore Res. Inst. *	2·2	+1·2	12·2		Ootacamund *	17·1	+9 0	42·2
	Trichinopoly	7·7	+3 9	15·8		Nanjanad *	14·0	+6 7	38·9

* Stations of the Agricultural Dept.

Summary of general weather conditions: The monsoon was generally strong on the west coast and in the Circars under the influence of three depressions in the Bay till the 10th. It then weakend and wide-spread thunderstorms occurred over the south of the peninsula till the end of the month.

The Bay depression which lay off Gopalpore at the end of the last month, crossed the coast near that station on the 2nd and disappeared rapidly. A low pressure wave propagated across Burma, developed into a storm over the head of the Bay on the 2nd and crossed the coast near Chandbali on the 3rd. It then moved in a north-westerly direction and filled up over west Rajputana on the 9th. A third depression appeared off the south Arakan coast on the 7th. as a result of the transmission westwards of a low pressure wave across Burma, and developing and moving rapidly, crossed the coast near Chandbali on the 9th. morning and moving across the Central Provinces, merged into the seasonal trough of low pressure over North-west India by the 12th. These three depressions gave rise to particularly heavy rain in Orissa and in the adjoining regions. Cuttack reporting 13 inches of rain on the 4th.

Pressure distribution over the peninsula after the 10th. was of an abnormal type being more of the transitional type than that usual in August, and determined wide-spread thunderstorms over the south of the area. Thunderstorm activity was most marked almost throughout the month after the 10th., in the Deccan and Mysore and adjoining regions.

Rainfall was markedly above normal in the Deccan, Mysore and the central districts, locally in excess in Ganjam, and in defect in the Malabar coast and locally in the Circars.

The chief falls reported were: Anantapur 4·3″ (27th); Bellary 3·9″ (21st); Cochin 3·9″ (22nd); Vellore 3·5″ (11th.) and Madura 3·0″ (19th).

Weather Report for the Research Institute Observatory:

Absolute maximum in shade	91·5°
Absolute minimum in shade	69·5°
Mean maximum in shade	87·1°
Departure from normal	− 0·4°
Mean minimum in shade	71·5°
Departure from normal	...
Total Rainfall for month	2·16″
Departure from normal	+ 1·15″
Heaviest fall in 24 hrs.	0·92″
No. of rainy days	4
Mean daily wind velocity	4·6 M. P. H.
Mean humidity at 8 hrs.	80·2 %
Departure from normal	+ 6·9 %
Total hours of bright sunshine	193·9
Mean daily hours of bright sunshine	6·3

General weather conditions: The monsoon was generally active during the first ten days of the month. It then weakened and thunderstorms were very frequent especially during the last fortnight. Rainfall was markedly in excess and occurred in connection with thunderstorms.

Day and night temperatures were nearly normal during the month.

P. V. R. & T. S. L.

Departmental Notifications.

I Circle. I. Kurma Rao, A. F. M. Anakapalle, l. a. p., for one month from 3—8—'33. P. Lakshminarayana, A. A. D. Narasapur extension of l. a. p. on m. c. for 19 days from 13—8—'33. B. P. Papiah A. A. D., Yellamanchilli transferred to Tadeppallegudem Vice D. Bapaiah transferred to Guntur. B. Venkataramana transferred to I Circle. A. Rammohan Rao A. D. Rajahmundry to Peddapur subcircle. A. Kondayya Sarma A. A. D. Tanuku, to Razole. D. Hanumantha Rao A. D. Razole, to Tanuku. **III Circle.** A. Gulam Ahmad, offg. F. M. Hagari, extension of leave on m. c. on half average pay for 15 days from 3—8—'33. K. Balaji Rao A. F. M. Hagari, extension of l. a. p. on m. c. for six months in continuation of leave already granted. **IV Circle.** K. Varadachari, F. M. Palur l. a. p. for two months from 7—8—'33. M. A. Balakrishna Iyer, A. D. Walajah l. a. p. for 10 days from 4—9—'33. C. Annamalai A. D. Palmaneir posted to Trivellore, to be in charge of motor exhibition van. M. Gopalan Unnithun A. D. on return from leave posted to Gudiyattam. M. K. Swaminathan A. D. Gudiyattam as A. D. Vellore. **V Circle.** M. Subbiah Pillai, Assistant, Agricultural Research Station, Aduturai, l. a. p. for 12 days from 22—8—'33. **VI Circle.** A. Ramalinga Iyer A. D. on return from leave posted to Koilpatti. K. Ramaswami Iyer A. D. Koilpatti l. a. p. for three months from 1—9—'33. A. M. Muthiah Nattar, A. D. Dindgul l. a. p. for three weeks from 20—8—'33. S. Bhima Raju A. A. D. Tinnevelly l. a. p. for one month from 1—9—'33. A. Ramalinga Iyer, extension of l. a. p. for ten days in continuation of leave already granted. C. S. Rajaratnam Mudaliar A. A. D. extension of l. a. p. on m. c. for one month in continuation of leave already granted C. S. Namasivayam Pillai A. A. D. l. a. p. on m. c. for one month from the date of relief K. Sivasankara Menon A. D. Dharmapuri l. a. p. for two months from the date of relief. K. Kuppamuthu A. D. under training to join duty at Dharmapuri. **Paddy Section.** S. Dharmalingam Mudaliar, Assistant, l. a. p. for 10 days from 2—9—'33. V. M. Ramunni Kidavu F. M. Pattambi l. a. p. for 25 days from 22—8—'33. **Cotton Section.** S. M. Kalyanaraman, Assistant, extension of l. a. p. for one month in continuation of leave already granted. K. L. Ramakrishna Rao, Assistant, l. a. p. for 12 days from 7—8—'33. **Chemistry Section.** K. Veerabhadra Rao, offg. Assistant, Anakapalle, extension of l. a. p. for 2 days on 1st and 2nd September, 1933. **Millets Section.** P. V. Hariharan l. a. p. on m. c. for 6 weeks from 26—8—'33. S. Madhava Rao l. a. p. for 6 days from 4—9—'33. **Entomology Section.** John A. Mulyil, Assistant, leave for two years from 22—8—'33. A. G. Ramaswamiah, subassistant, extension of l. a. p. for one month in continuation of leave already granted. **D. A's. Orders.** A. Chinnathambi Pillai, l. a. p. for 2 months and 19 days from the date of his reversion to the Madras Agricultural Subordinate Service. L. Krishnan whose officiating appointment terminates on the 19th. August, will continue to officiate till 16th. September '33. C. Narasimha Acharya Assistant Lecturer in Chemistry, leave on half average pay for one year, one month and fourteen days from 1—9—'33 for the purpose of higher studies in England. **Transfers.** B. Venkataraman, A. A. D. Guntur, to I circle. D. Bapaiah A. D. Tadepallegudem to II circle. A. Kondayya Sarma, A. A. D. Tanuku, l. a. p. for one month on m. c. from 1—9—33. Dr. S. Kasinatha Iyer on return from leave on the 15th. September, will join duty as Assistant in the Chemistry Section. He will however, work in the Cotton Specialist's Laboratory till further orders. D. V. Krishna Rao whose offg. appointment as Assistant in the chemistry section will terminate on 14th. September '33, will continue to officiate till 18th. November, 1933.

ADDITIONS TO THE LIBRARY DURING JUNE 1933.

A. Books.

1. Hungarian Alkali Soils and Methods of their Reclamation (California Agri. Expt. Stn. Spec. Pub.) *A J. Sigmond* (1927). 2. International Year Book of Agricultural Statistics—1930-31. *League of Nations Pub.* (1931). 3. The Agricultural Situation in 1930-31. (1932). 4. New Experiments in Electro Farming (U. P. Agri. Dept. Bull. 62). *S. Nehru* (1933). 5. The Significance of Nitrogen. *J. E. Zenetti* (1932). 6. The Sheep Blowfly in Australia. *Tillyard* (1933). 7. Evolution Considered in the light of Hybridization. *J P. Lotsy* (1925), 8. Plant Physiology: Laboratory Directions. *W. F. Loehwing* (1932). 9. New Conceptions in Biochemistry. *N. R. Dhar* (1932). 10. Fats and Oils: A General View. *C. L. Alsberg and A. E. Taylor* (1928). 11. Copra and Cocoanut Oil. *K. Snodgrass* (1928). 12. Observations on Citrus Insects and their Control in many parts of the World. *F. E. Bodenheimer* (1932). 13. British Agricultural Meteorological Scheme—Observers' Hand Book. (1929). 14. Instructions to Observers at the Second and Third Class Observatories. *S. C. Roy* (1930). 15. The Year Book of the Universities of the Empire—1933. *H. F. Heath* (1933). 16. Guide to the Cataloguing of Periodicals. *A. L. A. Pub.* (1931). 17. Guide to the Cataloguing of the Serial Publications of Societies and Institutions. (1931).

B. Reports.

1. Scientific Reports of the Imperial Institute of Agricultural Research, Pusa—1930-31. 2. Third Report showing the Progress made in giving effect to the recommendations of the Royal Commission on Agriculture in India, during the Calendar Year 1931. Part I.—Central Government. 3. Third Report showing the progress made in giving effect to the recommendations of the Royal Commission on Agriculture in India up to the 31st December, 1931. Part II—Local Governments and Administrations. 4. Estimates of Area and Yield of Principal Crops in India 1931-32. 5. Annual Report: Empire Marketing Board—May 1932 to May 1933. 6. The National Institute of Agricultural Botany: Thirteenth Report and Account—1931-32. 7. Twenty-Eighth Annual Report for the twelve months ending December 31st, 1932 of the British Cotton Growing Association. 8. Live Stock Diseases Report (Recording Control Work during the year ended 30th June 1932) of the Department of Agriculture, New South Wales. 9. Official Year Book of the Commonwealth of Australia—No. 23 of 1930. 10. No. 24 of 1931. 11. Forty-Third Annual Report—1930 of Texas Agri. Expt. Station. 12. Forty-Fourth Annual Report 1931 of Texas Agri. Expt. Station. 13. Fifty-First Annual Report—1931-32 of Ohio Agri. Expt. Station. 14. Forty-Fifth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the year ended June 30, 1932.

C. Bulletins, Memoirs &c.

15. Life Histories of Indian Micro-Lepidoptera (Second Series) Alucitidae (Pterophoridae) Tortricina and Gelechidae. *Imp. Coun. Agri. Res. Pub. Sci. Monograph No 2.* 16. Soap Making as Cottage Industry in Bihar and Orissa. *Bihar and Orissa Dept. of Ind. Bull. No. 5 M. I. S.* 17. An Optical Lever Siltometer. *Punjab Irr. Res. Inst. Res. Pub. Vol. V—No. 1—January 1933.* 18. Resin Secretion on Different Host Plants by the Lac Insect. 19. Shellac Drying Oil Combinations. 20. Pruning and Cropping. *Ind. Loc. Res. Inst. Bull No. 11, 1932, 12, 13, 1933.* 21. Land Amelioration in Germany with Special reference to Drainage Research Work. *Imp. Bur. Soil Science Tech Comm. No 27.* 22. Home-Grown Feeding Stuffs. 23. Fruit and Vegetable Production for Commercial Canning. 24. The Housing of Poultry. *Eng. Mini. Agri. and Fish. Bull. Nos. 13, 45, 56.* 25. Co-operative Marketing Makes Steady Growth. 26. Statistics of Farmers' Selling and

Buying Associations—United States. 1863–1931. *Washington Federal Farm Board Bull No. 8, April 1932, No. 9, June 1932.* 27. Prehistory in the Light of Genetics by E. Clarke and J. B. S. Haldane. *Royal Inst. of Great Britain Pub.—1931.* 28. Old and New Standpoints on Senile Degeneration by A. P. C. Bijhouwer. *Special Pub.* 29. The Engineering Aspects of the Condensing and Drying of Milk. by A. W. Scott and A. M. I. Mech. E. *Hannah Dairy Res. Ist. Bull. No. 4.* 30. Cytological Studies in Cotton; 1. The Mitosis and Meiosis in Diploid and Triploid Asiatic Cotton by A. Skovsted. *Trinidad Cotton Res. Mem. Ser. A., Genetics No. 5.* 31. Beans; Standard Descriptions of Vegetables. *Dominion of Canada Agri. Dept. Bull No 153 New Ser.* 32. Insect Pests of Grain in Alberta. *Alberta Agri. Coll. Bull. 24.* 33. Experimental Milling and Baking Tests on South African Wheat Varieties. 34. Studies in the Keeping Quality of Fruit 1. *Union of S. Africa Agri. Dep. Sci. Bull. Nos. 116, 118.* 35 Production of Flue-cured Tobacco. *Union of S. Africa Agri. Dept. Bull. No. 120.* 36. Methods for the Identification of the Coloured Woods of the Genus Eucalyptus. 37. A Soil Survey of King Island. 38. Varieties of Wheat in Australia. *Australia Coun. Sci. and Ind. Res Bull. Nos. 67, 70, 72.* 39. Tobacco Production in Australia. *Australia Tobacco Invest. Bull. No. 3.* 40. Butter Over-run and Factors affecting it under New Zealand Manufacturing Conditions. *New Zealand Dairy Res. Inst. Pub. No. 31.* 41. Cotton Experiments, 1925–26. 42. Sugarcane in Uganda. *Uganda Agri. Dep. Cir. Nos 16, 19.* 43 Life History of the Angoumois Grain Moth in Maryland. 44. The Bonavist, Lablab, or Hyacinth Bean. 45. Motion Pictures of the United States Department of Agriculture, 1932. 46. List of Publications of the United States Department of Agriculture from January, 1926 to December, 1930, inclusive. *U. S. Agri. Dept. Tech. Bull. Nos. 351, 318, Mis. Pub. 152, 153.* 47. Transferring Bees to Modern Hives. 48. Sweetpotato Growing. 49. Commercial Comb-Honey Production 50. Beekeeping in the Clover Region. 51. Seed Potatoes and How to Produce them. 52. Black Walnut for Timber and Nuts. 53. Turkey Raising. 54. Heating the Farm Home. *U. S. A. Far. Bull. Nos. 961, 999, 1039, 1215, 1332, 1392, 1409, 1698* 55. Grafting Tropical Fruit Trees in Hawaii. *Hawaii A. E. S. Cir. No. 6,* 56. Genetics and Breeding in the Improvement of Soybean. *Illinois A. E. S. Bull. No 381.* 57. Wholesale Prices for 213 Years, 1720–1932:— Part I, Wholesale Prices in the United States for 135 years, 1797 to 1932. Part II, Wholesale Prices at New York City, 1720 to 1800. *Cornell A. E. S. Mem. 142.* 58. Field Control of Sugarcane Root Disease Conditions. 59. A Summary of the Investigations of the Sugarcane Moth Stalkborer in Cuba. *Tropical Plant Res. Found. Bull. Nos. 6, 8.* 60. A Survey of Storage Conditions in Libraries relative to the Preservation of Records. *U. S. Bur. of Standards Mis. Pubc. No. 128.* 61. Wheelbarrows: Simplified Practice R. 105–32. *U. S. Dept. Bur. of Standards R. 105–32. Wheelbarrows.* 62. The Chemical Composition and Nutritive Properties of Milk as affected by the Level of Protein Feeding. Part I. Chemical Composition. Part II, Nutritive Properties. 63. A Survey of Ohio Orchard Soils Relative to Phosphorus Distribution and Acidity. 64. Studies on the Nutritive Value of Milk, II. The effect of Pasteurization on some of the Nutritive Properties of Milk. *Ohio A. E. S. Bull. Nos. 515, 517, 518.* 65. The Quality of Vegetable Seeds on Sale in New York in 1932. 66. Effects of Fertilizers and Rotation on Earliness and Total Yields of Tomatoes. *New York A. E. S. Bull. Nos. 618, 619.* 67. The Blackberry Mite and its Control. 68. The Potato Flea Beetles: Epitrix Cucumeris Harris Epitrix, Suberinita Leconte. *Pullman A. E. S. Bull. Nos. 279, 280.* 69. The Texation of Farmers in South Carolina. 70. Texation and Ability to Pay in South Carolina. 71. An Economic Study of Sumter County Agriculture. *South Carolina A E S. Bull. Nos. 285, 286, 288.* 72. Anatomy of Phaseolus Vulgaris, L. Var. Black Valentine. 73. Studies on the Biological Decomposition of Pest. 74. Field Studies of Sports in Michigan Fruit Trees. 75. The Rock Garden. 76. Rural School Organization in Michigan. *Michigan A. E. S. Tech. Bull. Nos. 128,*

129, 130, Spl. Bull. Nos. 228, 229, 77. The Fertilizing Valne of Green Sand. 78. The Effect of Cotton Seed Meal and other Feeds on the Storage Quality of Eggs. 79. Relations of Buffer Capacity for Acids to Basicity and Exchangeable Bases of the Soil. 80. The Composition and Fertilizing Value of Sewage Sludge. 81. Trees and Shrubs in Northwest Texas. 82. The Mechanical Harvesting of Cotton. 83 An Economic Study of Farm Organization in the Piney Woods Farming Area of Texas. 84. Inequalities in Taxation of Farm Lands and City Property Due to Scope and Method of Assessment. 85. Grain Sorghum Varieties in Texas. 86. Probability Tables for Mendelian Ratios with Small Numbers. 87. Fig Culture in the Gulf Coast Region of Texas. 88. Quantities of Vitamin A required by Pullets for Maintenance and for Egg Production. *Texas A. E. S. Bull. Nos. 428, 429, 442, 445, 447, 452, 453, 458, 459, 463, 466, 468.* 88(a). Sorghum Crops on the High Plains of Oklahoma. 88(b). Sorghums for Grain and Forage. *Oklahoma A. E S. Bull. Nos. 191, 210.* 89. The Putting Green: Its Planting and Care. 90. Lawn Making and Maintenanze. *O. M. Scott & Sons Co., Pub. Ohio. Pub. 1931, 1932* 91. Aero Cyanamid Granular. 92. Directions for Using Granular Aero Cyanamid. 93. The Cyanamid Plan for Growing Cotton and Corn. 94. The Cyanamid Plan for Growing Truck Crops. *American Cyanamid Co., Pub.*

D. Circulars, Leaflets &c.

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